Harwell . . . . .

certain elements are bombarded with very large numbers of neutrons, such as are present in an atomic pile, they become radio-active. The radio-active elements which are formed have the same chemical properties as the ordinary inactive forms of the elements, but differ in emitting radiation. Most of the materials irradiated in the Harwell piles are in the form either of metals or chemical salts. The procedure is very simple: the substance required is weighed out into a small aluminium can which is placed in a graphite block and the block then pushed into the middle of the pile. There it stays for a suitable time—which might be days, weeks or months—until the enormous flux of neutrons has made it suitably strong in radioactivity. The radio isotope is then ready to be sent to the user. It is packed for transport in a lead-lined box and each box is carefully measured before despatch so as to ensure that no danger to health exists. The levels of radiation permitted are laid down by the Medical Research Council and elaborate means are provided at Harwell for their accurate determination.

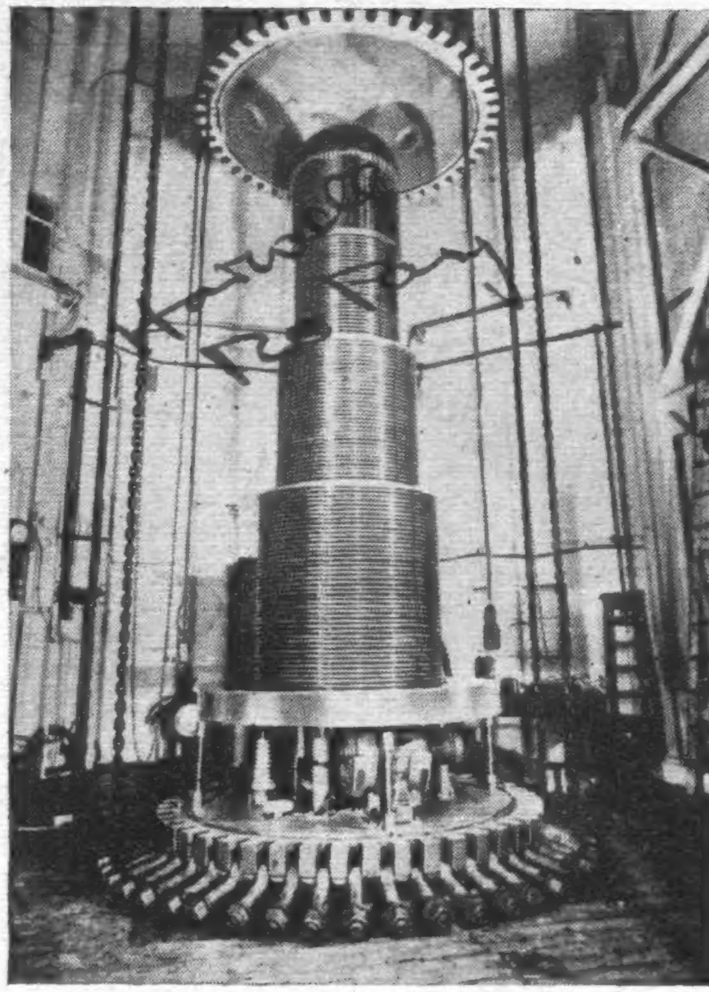
Cyclotron

Among the more spectacular items of equipment at Harwell are the cyclotron and Van de Graaff electrostatic generator. The cyclotron consists of a 700-ton magnet with poles 110in in diameter between which nuclear particles (usually protons or deuterons) can be whirled round in a spiral path and speeded up in successive small steps to energies of 200,000,000 volts. This machine, the largest of its kind in Europe and only second to the 184in-diameter cyclotron in California, will enable the nuclei of most atoms to be broken up into fragments and will provide nuclei of new types which even the piles cannot produce.

The Van de Graaff generator has an output of 5 million volts and is housed in one of the cyclorama towers used for navigational training when Harwell was in R.A.F. hands. The principle of the generator is quite simple. An insulated tower is enclosed in a pressure casing which is filled with gas to a pressure of about 25 atmospheres to prevent sparking to earth. Running up the centre of the tower is a belt-conveyor whereby the electric charge is transferred from earth to the terminal at the crown. The conveyor belt is made of a rubberized fabric and is "loaded" and "unloaded" by a comb of needle points at top and bottom which cause a discharge to and from the belt surface. The 50,000 volts needed to make this discharge occur are provided from an auxiliary supply. The 5 million volts produced by the machine are used to accelerate hydrogen nuclei in a vacuum tube running down the centre of the tower, from which they emerge into a pit below, where they are used to study the properties of atomic nuclei.

The Laboratories

Of the new buildings being constructed at Harwell, the radiochemical laboratory is certainly the most interesting of which anything can be said. This building has been designed for the safe handling of all types of radioactive material in laboratory quantities. It comprises an administrative block containing offices, stores, workshops, conference room and special laboratories for inactive work, and two laboratory wings for radio-active work which are connected to the administrative block by means of air locks and changing rooms. The two wings house twelve laboratory suites, each containing a laboratory, office, shower bath and vestibule, and each laboratory can easily be isolated from the rest of the building. Construction and interior finish is such as to warrant the term "aseptic" in that there is a complete absence of ledges and angular corners in which radio-active dust could be trapped. Lead-lined fume cupboards and specimen store cupboards are integrally built in each laboratory and, as part of the health precaution system, a relatively enormous ventilation plant is provided, the ducts of which occupy the whole upper



Interior of Van de Graaff 5-million volt electrostatic generator showing, at top, the enclosing pressure chamber.

floor of the building—approximately 60 per cent of the total volume. The rate of air change is extremely high and dispersion of radio-active dusts into the atmosphere with the exhausted air is guarded against by passing the air through electrosatic precipitators.

In our last week's issue, we referred to a paper read before the Detroit section of the Society of Automotive Engineers on the subject of atomic propulsion for aircraft. Whilst at Harwell, we had the opportunity of obtaining the views of the Director, Professor Sir John Cockcroft, on this subject. Put briefly and bluntly, Sir John was quite discouraging. The bugbear lies in the provision of adequate protective shielding against the emission of radio-active rays, and it is an unfortunate physical fact that materials which have effective shielding qualities are those of high specific densities. In this connection, although unable and unwilling to be precise about figures, Sir John mentioned a shield weight of something like 50 tons being necessary for an atomic power plant delivering 10,000 h.p. Furthermore, he thought that this was fundamental and not merely a question of search for some new shielding material. Thus, although we may well see atomic heat source applied to gas turbines for the propulsion of ships and, possibly, trains in the years to come, it would seem to be unlikely that it will extend to the aeronautical field—at least as a useful prime mover.

600 M.P.H. SHOOTING STARS

THE fitting of a more powerful Allison turbojet, generally similar to that which propelled a specially prepared Lockheed Shooting Star at 623 m.p.h., enables a new fighter variant —the F-80C—to attain 600 m.p.h. Hitherto the Lockheed Company has been cautious in quoting speed figures for the Shooting Star fighter, but it is now stated that the speed of the standard F-80B is 550 m.p.h. For the F-80C it is further claimed that it has "the greatest range of any operational jet fighter." During the past three years more than 1,000 Shooting Stars have been built and a contract is now in hand for 457 F-80Cs.